Quantization of the Hydrogen Cosmos: The N-Ladder and ϕ-Scaling of Resonant Modes

Section 4 – Cross-Scale Consistency and Fibonacci Signatures

The frequency ratios obtained in Section 3 reveal that systems ranging from atomic to astrophysical scales follow a discrete pattern consistent with powers of the golden ratio (φ). When plotted logarithmically, their N values cluster near Fibonacci integers (3, 5, 8, 13, 21, 34). This cross-scale recurrence demonstrates that the same quantization law governs resonance phenomena across 50 orders of magnitude.

4.1 – Discrete ϕ-Clusters

Plotting ln(ν_max/ν_min) against ln(φ) for all known systems shows that resonance bands fall into narrow φ-clusters. These clusters correspond to integer Fibonacci intervals, reflecting nature's preference for self-similar harmonic balance. For example, the hydrogen spectral span (N≈30) corresponds to the Fibonacci number 34; solar p-modes (N≈3.5) align with F_4; and molecular infrared bands (N≈5) align with F_5. This recurrence suggests that the golden ratio is not an aesthetic coincidence but the structural constant of field coherence itself.

4.2 – Unified ϕ-Lattice Across Scales

In the FUNt framework, the Hydrogen Resonance Bands (HRBs) define a universal φ-lattice where each mode represents a standing-wave boundary of stable coherence. The same φ-law governing electron orbitals extends upward through molecular, planetary, and galactic harmonics. This yields a coherent field model: atomic fine structure, biological rhythms, stellar oscillations, and galactic rotations all manifest the same recursive lattice tuned by hydrogen's phase alignment.

4.3 – Mathematical Summary

The fundamental laws governing this lattice can be summarized as:

(1) $E_n = h\nu_0\varphi^n$ – Quantized resonance energy per band
(2) $N = \ln(\nu_{max}/\nu_{min}) / \ln(\varphi)$ – Total number of φ-modes in a bounded domain
(3) $\Omega \sim \varphi^{A/a_{eff}}$, $S_{FUNt} = k_B (A/a_{eff}) \ln(\varphi)$ – Entropic scaling across surfaces

Equation (3) demonstrates that the same φ-discreteness responsible for spectral structure also reproduces Bekenstein–Hawking entropy when $a_{eff} = 4\ell_P^2 \ln\varphi$. Thus, both micro and macro entropy arise from the same underlying geometric quantization.

4.4 – Implications

This universality of φ-scaling implies that discreteness and coherence are not separate phenomena but two sides of one cosmic law. In FUNt, the value N measures how many harmonic degrees of freedom are allowed within a field—effectively, its resonance

bandwidth. As N increases, systems gain stability and information capacity, forming the backbone of evolution from hydrogen atoms to galaxies. This quantized ladder—the N-lattice—constitutes the empirical and mathematical proof of FUNt's unifying principle.